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ABSTRACT

In a problem-based curriculum, emphasis is placed on the groups in which students learn to analyze problems and to contribute to the solution of a problem. This paper describes an instrument that aims to measure individual group performing and presents some psychometric results. Reliability and validity were studied with 240 students in groups of 9 with 1 tutor. The instrument appears to be reliable, with coefficient alpha varying from 0.84 to 0.92, and it seems that it is a valid measure for characteristics that are important in a problem-based curriculum: (1) participating in discussions; (2) explaining things to other students; and (3) a broad study approach. (Contains 2 tables and 11 references.) (SLD)

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GROUP PERFORMING IN A PROBLEM-BASED CURRICULUM: The development and evaluation of an instrument.[1]

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ABSTRACT

In a problem-based curriculum emphasis is given to groups. In a group students learn to analyze problems and to contribute to the solution of the problem. Students also learn to cooperate. The paper describes an instrument which aims to measure individual group performing. Also some psychometric results are presented. The instrument turns out to be reliable (coefficient alpha varies from 0.84 to 0.92) and it seems that the instrument is a valid measure for characteristics which are important in a problem -based curriculum: participating in discussion, explaining to other students, and a broad study -approach.

INTRODUCTION

Education is generally seen as a process of transmission of (Barrows, 1983; Bruhn, 1992; Schmidt, 1993; Van der Vleuten & Wijnen, 1990). There are teachers who have knowledge at their disposal. They passes this onto a student. The student receives knowledge from the master. One could also approach education from the other direction, beginning with the student who wishes to acquire knowledge and who comes to an education institution, which provides the opportunities and tools for this purpose. These could be books or articles, audio - visual aids, or practical attachments, fellow -students or teachers. The teacher is, in this case, no longer the person, who provides students with ready -made materials in the form of lectures and notes. Instead the teachers become the student's guides, who stimulate the learning process and, where necessary, indicate the direction that it can take. As a result, education is no longer, as is generally the case, teacher- centered, but student-centered (Van Berkel, 1990; Norman & Schmidt, 1992).

The process of problem- based learning starts with an analysis of the problem that is offered by (one of) the assignment(s) in the block boo k. Students discuss in a group session the nature of the problem and think of as much knowledge that is possibly related to the subject. Students utter freely the considerations and ideas/inventions that come into mind as free associations during the brain storming phase. After that a critical evaluation takes place of the proposed knowledge items and points of consideration, the group tries to weigh the propositions on their relevance and importance both in relation to the specific problem considered and to the knowledge domain where the problem was taken from, and position the not discarded topics into a structured frame of reference. At the end of this first group

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session the group determines which aspects they want to investigate more deeply. These aspects are recorded in 'learning objectives', stated in the form of questions that guide the self study activities that take place between the first and second group session. All group members occupy themselves individually or in cooperation with other students with the connected study topics with the help of handbooks, literature, etc. At the following group meeting an inventory is made of the results of this study. This will often lead to group discussion. Two members of the group can, for example, arrive at d ifferent answers to the same question, or it can be that the material that has been studied, does not provide sufficient clarity. Being critically active with the information one has found, increases the depth of insight into the problem (Schor et al., 1997; Norman & Schmidt, 1992; Schmidt & Moust, 1995). If the group determines that they have made sufficient progress with a problem, they start with the next assignment in the block book.

Besides content-oriented learning goals, social skills and attitudes are also essential in preparing for a profession, e.g.: active listening to students, acquiring professional attitude in problem settings, verbal participating in a discussion, playing the role of chairman, and reporting in the group about individual study activities (Van Berkel, 1990). This kind of learning objective is not evaluated in the end- of-course test. The faculty of Health Sciences at the Maastricht University developed an instrument for qualifying students' performing in tutorial groups. The objective of this study is to evaluate the instrument.

INSTRUMENT

At the end of a course the tutor judges the adequacy of students group performing/participation with regard to the following criteria for effective performing in problem-based group learning.

1 Contribution to the analysis of the problem and to the statement of the learning- goals;
2 Keeping one's agreement;
3 Contribution to the discussion concerning the collected data;
4 Fulfilling the role of chairman in a group session;
5 Contribution to the promotion of the group process.

The judgement of the tutor is a dichotomous one: a student receives or receives not a so -called 'PTG-point' (*P*erforming in *T*utorial *G*roups -points). There is a limit to the number of PTG-points a tutor may distribute: the maximum number of points may not exceed the number of group members divided by two. The faculty decided for the limit because a pilot experience of the method demonstrated that tutors are too generous: they donated almost every student in the group with a point, because tutors found it hard to disqualify students. This is not an unusual finding. In face-to-face judgements there is a consistent lack of discrimination. So it was compulsory for tutors to use normative based judgements, although it is presume d that in this situation criterion-based judgements are favorable: if each student performs well according to the criteria, each student deserves a PTG -point. On the other hand, it turns out that the mean percentage of distributed PTG -points was 31%, in stead of 50%. So in practice the tutors judged criterion-based.

Because there are six courses a year, the maximum number of points a student can receive in a year, is six. To a certain degree, the collected points can compensate the score on the end-of-unit test (see Van Berkel, 1995).

PROCEDURE

To determine the psychometric qualities of the instrument an evaluation study was initiated. In a parallel judgment procedure all the group participants, tutor and students, were asked to choose the three fellow students who to their opinion were the best candidates to receive a PTG-point, and state their names in order of preference. Next these three students had to be rated on a list of characteristics that constitutes an operationalization of the five judgment criteria in terms of group performing behavior (scheme 1). These operationalizations were taken from several studies regarding problem-based learning (Schmidt, 1993; Norman & Schmidt, 1992; Cariaga-lo et al., 1996).

(Insert scheme 1 here)

ANALYSIS

The psychometric analysis applied to these data consisted of two parts. First, the inter-rater reliability of the parallel PTG-judgment was calculated by computing coefficient alpha. Second, the validity of the judgment procedure was determined by its predictability from behavior characteristics.

Reliability

The population comprised 240 students. Because this population is randomly assigned to tutorial groups, all the judgment panels (i.e., each nine fellow students and a tutor), can legitimately be regarded as replications, just as is the case with parallel tests. So, it is justified to calculate alpha reliability on a 'test' matrix, containing ten items for each judged student in the population (Thorndike, 1982). Alpha coefficient was 0.88, a remarkable high value. This result means that there is a strong agreement among students on which students can be rewarded with a PTG-point. We also computed the correlation between the rating of the tutor and the ratings in the parallel judgment procedure used in t he evaluation study. The correlation was 0.87, indicating that the judgment procedure in this study is highly representative to the qualifications that students assign in the formal context.

Validity

Predictability of group performing judgment was determi ned against two criterion variables.

1. receiving a PTG-point by the tutor, (scored: yes/no)
2. the number of received PTG -points by the students.

The prediction of these two criteria was investigated by means of discriminant -analysis (criterion 1) and regression analysis (criterion 2).
The discriminant function, determined by entering all twenty behavior characteristics of the questionnaire, delivered a correct classification for 81% of the students on the criterion: yes or no a PTG-point. (When the PTG-points are randomly assigned the percentage correct classification is of course 50).

(Insert table 1 here)

The items which show the highest correlation (=> 0.30) with the discriminant function are the items 01 (r = 0.62), 20 (-0.51), 16 (0.47), 03 (0.41), and 14 (0.31).

The regression analysis (Method: Enter) indicated that the twenty items explain 56% of the variance in criterion 2 (see table 2).

(Insert table 2 here)

The items that showed to be the most important in the discriminant analysis related to criterion 1, were also the ones that contributed significantly to the regression results for criterion 2: item 01 (Beta = 0.39), 16 (0.27), 14 (0.22), 03 (0.17%), except item 20, that received a beta value of only 0.05.

CONCLUSION AND DISCUSSION

Only five of the twenty behavior characteristics contribute significantly to a prediction of PTG-ratings (regression analysis), although most of the items ideally are to be regarded as highly relevant indicators of the five judgment criteria. Clearly the most important factor that determines a students chance on receiving a PTG -qualification, is his/her verbal dominancy in the group (items 01, 20), but some important qualitative aspects of group performing likewise contribute substantially (items 03, 14, 16). The activities referred to in these items, mainly concern the presentation of acquired knowledge (items 03, 16).
Interrater-reliability appears to be high. Apparently it is evident to most group members which of them should be assigned the PTG-point. This is not a surprising result, looking at the best predictor of the PTG-score, the amount of students' talking in the group, because talking as such is a clearly observable characteristic. But it appears that also other, less clear- cut aspects play a role of significance in the valuation of a student by other participants as 'contributing to group effectiveness'. With respect to these characteristics (like 'uses a broad perspective') reasonably much more divergence in position could be expected between judges, resulting in less homogeneity of their qualifications.

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Scheme 1: Characteristics of group performing behavior

Item	Characteristic
01	Talks little/much
02	Produces useful ideas
03	Explains to other students in the group
04	Asks for explanations
05	Poses questions to the tutor
06	Reacts to questions/suggestions of the tutor
07	Makes corrections on other group members' contributions
08	Does not just accept information as being true
09	Watches over the discussion in general
10	Is prepared to fulfill the role of chair
11	Takes position with regard to the process of group cooperation
12	States opinions about the advisable task approach
13	Works hard during self study time
14	Uses a broad perspective in his/her study approach
15	Always completes his/her home work
16	Supplies an useful contribution to reporting activities
17	Gives the impression to be interested
18	His/her choice of activities is ruled by weighing considerations of usefulness
19	Poses high demands on learning results
20	Seems to be inhibited to say a lot

Table 1: Correlations between characteristics of group performing behavior and the discrimination function

Item	Characteristic	Correlation
01	Talks little/much	0.62
02	Produces useful ideas	0.23
03	Explains to other students in the group	0.41
04	Asks for explanations	0.10
05	Poses questions to the tutor	0.08
06	Reacts to questions/suggestions of the tutor	0.23
07	Makes corrections on other group members' contributions	0.01
08	Does not just accept information as being true	0.10
09	Watches over the discussion in general	0.14
10	Is prepared to fulfill the role of chair	0.15
11	Takes position with regard to the process of group cooperation	0.28
12	States opinions about the advisable task approach	0.17
13	Works hard during self study time	0.29
14	Uses a broad perspective in his/her study approach	0.31
15	Always completes his/her home work	0.21
16	Supplies an useful contribution to reporting activities	0.47
17	Gives the impression to be interested	0.18
18	His/her choice of activities is ruled by weighing considerations of usefulness	0.08
19	Poses high demands on learning results	0.16
20	Seems to be inhibited to say a lot	-0.51

Table 2: Multiple regression analysis (method Enter): Getting a PTG-point (independent variable) and characteristics of group performing behavior (dependent variables)

Item	*Characteristic*	*Beta*	*Significance*
01	Talks little/much	0.39	0.00
02	Produces useful ideas	-0.17	0.04
03	Explains to other students in the group	0.17	0.[illegible]
04	Asks for explanations	-0.09	
05	Poses questions to the tutor	0.06	
06	Reacts to questions/suggestions of the tutor	0.01	
07	Makes corrections on other group members' contributions	-0.15	0.09
08	Does not just accept information as being true	-0.07	
09	Watches over the discussion in general	0.13	0.07
10	Is prepared to fulfill the role of chair	-0.01	
11	Takes position with regard to the process of group cooperation	-0.11	
12	States opinions about the advisable task approach	0.01	
13	Works hard during self study time	-0.04	
14	Uses a broad perspective in his/her study approach	0.22	0.00
15	Always completes his/her home work	0.04	
16	Supplies an useful contribution to reporting activities	0.27	0.01
17	Gives the impression to be interested	0.00	
18	His/her choice of activities is ruled by weighing considerations of usefulness	-0.04	
19	Poses high demands on learning results	0.14	0.09
20	Seems to be inhibited to say a lot	-0.05	

Multiple R: 0.74
R-square 0.56
Sign. F: 0.00